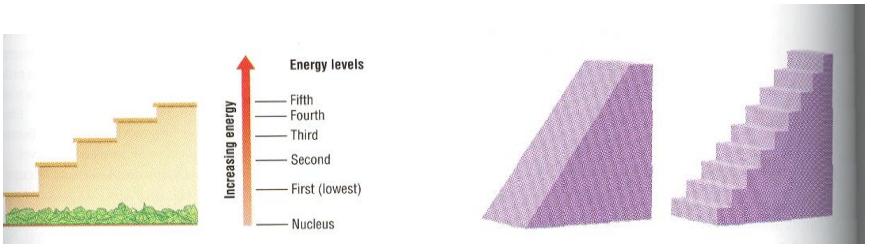
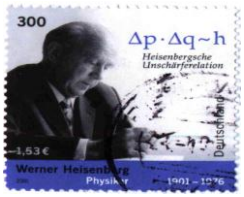
Chapter 5 Quantum Mechanics

Planck-

Energy is_____- an electron in an atom is only "_____" to have certain _____, or to be at certain distances from the nucleus- not in between



The Modern View of the Atom



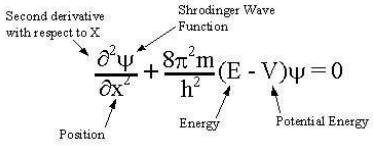
Heisenberg- Developed the "_____"

- this says that it is impossible to know both the _____and _____of an electron at the same time.

******This is not something that can be fixed with better equipment or experiments- there are limits to what we can know about the detailed structure on an atom.

Schrodinger

Wrote a "_____" that when solved gave the likely location of the electrons in an atom-_____ but likely (or high probability region in space).



What matters to us is that when this equation is solved, the answer gives a set of probabilities as to the likely location of the electron. This solution is a set of numbers known as "quantum numbers" and collectively they describe the high probability regions around the nucleus where the electron is allowed and will most likely be

Einstein

- Explained the _____- an observation that _____
_____

- *****Einstein never really believed that quantum mechanics was correct ---he was wrong on this one

- Describing Electrons

  - Quantum Number (Energy Level)-
    - They are a _____ to equations that give the most likely _____in an atom
    - They do not _____ as that is not possible

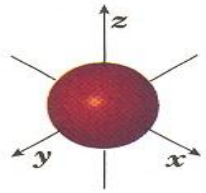
  - Energy Level (Principal Quantum Number)-

    - This corresponds mostly to the _____
      - Higher energy levels are located at a _____ distance from the nucleus
    - Energy levels have values of _____..etc
  - Energy Sublevel-
    - An electron's location within an energy level can be described in more detail by giving its "_____", which describes the _____of the region within the energy level where the_____is likely to be found
      - Each energy level is allowed to have_____sublevels
      - Sublevels
        - The first energy level has only _____sublevel_____
        - The second energy level is only allowed to have _____ sublevels _____
        - The third energy levels is only allowed to have_____sublevels
        - The fourth energy levels only has _____ sublevels
  - Orbitals-

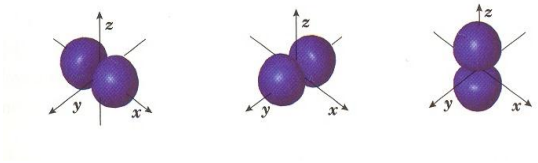
    - Each sublevel (s,p,d, or f) can have a _____ or_____.
    - We describe this by saying that each sublevel has a specific number of orbitals

○ Energy Sublevel	○ #of Orbits
○	○
○	○
○	○
○	○

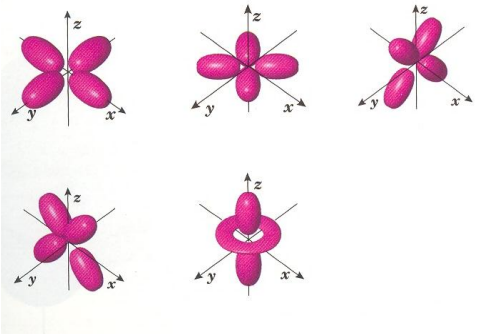
- What are orbitals?
  - Orbitals are what we say "_____" the electrons
  - We often draw them as_____ for short but they are just_____descriptions of regions in space where _____have a high_____of being at any moment
  - Each Orbit "_____" a maximum of two _____
  - Electrons are like spinning tops (_____)
    - Spin – PAULI EXCLUSION PRINICPLE
  - An orbital may be _____, have _____electron in it, or _____electrons in it
    - Hund's Rule –
- Orbital shapes –
  - S orbital



  - P Orbital



- D orbital



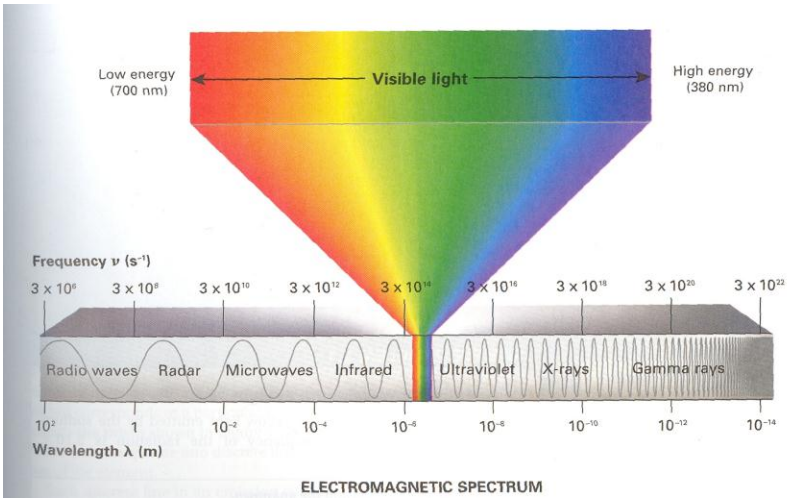
---A SUMMARY ---

Aufbau diagram-

Waves and Basics of Waves

- Light is a part of the _____, range of energies that travel as _____ waves
- We can see some of the energies ; however, most we can't
- Just like there are sounds too high or low for us to hear, there are light energies that are too high or low for our eyes to detect.

Electromagnetic Spectrum



Wave Basics

- Wavelength _____
  (unit = m or cm or some other length unit)
- Frequency- _____
  (unit = 1/sec of Hertz, Hz) often sec^{-1}
- Energy depends on the _____

How They Relate to Each Other

- Wavelength and frequency are _____related to each other (one goes _____, the other goes _____)
- Frequency and energy are _____related to each other (one goes _____, the other goes _____)
- Wavelength and energy are _____related to each other(one goes _____, the other goes _____)

Examples from the electromagnetic spectrum:

-
-
-
-
-
-

The Flame Test

-
-
-
-
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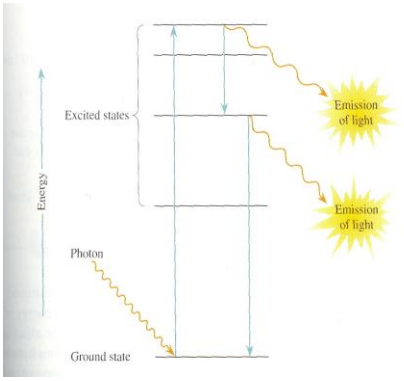
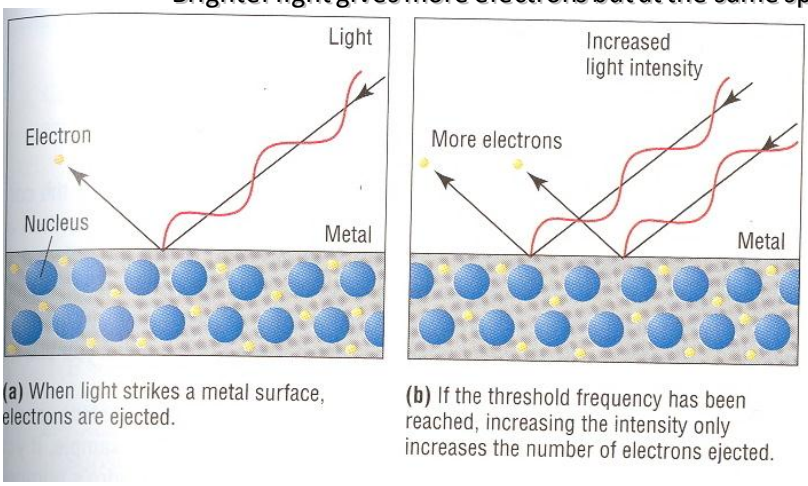


FIGURE 6-9
When an atom in its ground state absorbs a photon, the atom's energy increases, so the atom is converted to an excited state. Later, when the atom loses this extra energy, it may do so in more than one step, emitting one or more photons with lower energies in the process.

Photoelectric Effect

- This is what Einstein won the Nobel prize for (not relativity).
  - The photoelectric effect- when light shines on a metal electrons are ejected (not just raised to a higher E level, but ejected from the atom)
  - If the light shining on the metal has too low a frequency, no electrons are ejected
  - Once the minimum frequency (energy) is reached no more electrons are ejected, the ones that are ejected move faster.
  - Brighter light gives more electrons but at the same speed



(a) When light strikes a metal surface, electrons are ejected.

(b) If the threshold frequency has been reached, increasing the intensity only increases the number of electrons ejected.